Solid State Transmitter Investigation

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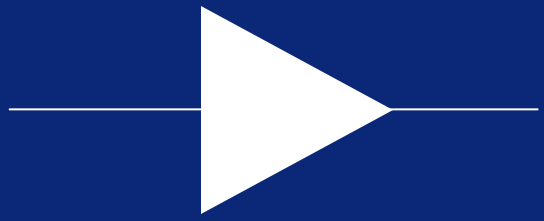
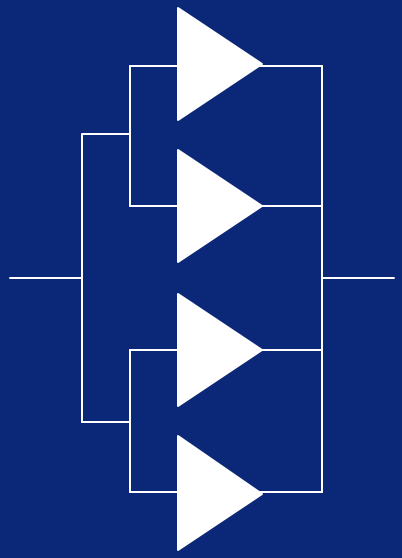
Transmitter Topology

USAF Weather Weapon System

- **NEXRAD**
  - **High Power Amplifier**
    - **Klystron**
  - **Line-type Modulator**
  - **High Voltage Trigger**
  - **High Efficiency**



- **Solid-state**
  - **Input Signal split**
  - **Parallel Array of RF Amplifiers**
  - **Lower Power Amplifiers**
  - **Output recombined**



Solid State Transmitter

USAF Weather Weapon System

- **Advantages of:**
  - **Soft Failure Mode**
    - **Reduced range, but still operational**
  - **Can complete maintenance while operating**
  - **Higher Duty Cycles**
  - **Low Peak Power (Although Improving)**
  - **Advanced Waveform Capability**
    - **Required for some applications**

- **Designed for battlefield, life critical operations and phased-array systems**

Solid State Transmitter

USAF Weather Weapon System

- **Disadvantages**
  - **Very Expensive***
    - **RF Amp (2.4kW max): $108K ea**
    - **RF Drive: $81K ea**
    - **Power Supplies (per RF Amp): $4.5K**
    - **Control and Monitoring: $11K**
  - **Advanced Waveforms require more receiver and signal processing horsepower**
  - **Pulse Compression not proven for weather application**

***Costing provided by DoD National Airspace System Program Office for ASR-11**

Solid State Transmitter

USAF Weather Weapon System

- **NEXRAD Application**
  - **750kW Peak Power**
    - **Would Require 312 RF Amp modules (w/o pulse compression)**
  - **ASR-11 utilizes 8 RF Amps for 18kW ($864K total)**
    - **Only 60 nm range**

- **NEXRAD Relevant Statistics**
  - **Klystron**
    - **MTBF 7.5 years : NEXRAD 8-9 years**
    - **$24K repair : $421K per year**
  - **NEXRAD Fleet Transmitter Support: $1.3M per year**

Solid State Transmitter Conclusion

USAF Weather Weapon System

- **Significant Technological Advantages**
  - **Lower Power**
  - **Advanced Waveforms**
- **Significant Maintenance Advantages**
  - **Graceful Degradation**
  - **Maintenance Actions while operational**
- **Currently Cost Prohibitive**
  - **$33M per transmitter for RF Amplifiers alone (w/o pulse compression)**

Summary Actions

USAF Weather Weapon System

- **Transmitter Reliability Report**
  - **226 Trigger Amplifiers in last 12 months**
  - **$224K per year**
  - **Development beginning to redesign to Trigger Amp**

- **Phased-Arrray Antenna**
  - **Currently being installed in Norman, OK**
  - **Aegis SPY-1D Antenna**
  - **Utilizes NEXRAD Transmitter**
  - **Potential when fielded to use T/R Modules**

- **Continue to monitor digital transmitter technology for future applicability**